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THE USE OF IMPROVED RISK TARGETING APPROACH IN SEISMIC HAZARD ASSESSMENT OF MAKRAN REGION

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In this paper, seismic risk in subduction zones is taken into account in a new way compared to probabilistic seismic hazard analysis (PSHA). As a new approach, seismic design maps that define risk-targeted ground motions (RTGM) such that buildings designed according to these maps will have explicit quantification of the limit-state (LS) objective, are developed. As used in (ASCE, 2017), 1% probability of exceedance (PoE) of collapse-LS in 50 years is brought. These maps are developed using by iterative risk calculation, wherein a generic building collapse fragility curve is convolved with hazard curve until target risk criteria are satisfied under the framework of performance-based earthquake engineering (PBEE) (Luco et al., 2007). The paper also explores the difficulties in implementing risk-targeting (RT) approach. It is shown that this current approach may be incorrect at locations where the tectonic environment is much different than that used to develop the hazard curve with the limited number of return periods (RP) using the PSHA. One could argue whether these hazard curves could be sufficient to determine the PoE of collapse-LS. Taking into account this issue, it is necessary to derive ground motions (GM) at wide range of RPs in PSHA projects. The more uncertainty exists, the more the effect of the shape of hazard curve appears. This approach can pave the path to highly challenging effects such as the contribution of earthquake GM with RP other than that fixed in uniform hazard method, or considering many uncertanties existed in structural capacity.

The procedure is illustrated by results of the case study: the Makran region of south eastern of Iran, an important, rapidly growing and seismic prone region bounded by subduction zone. In this regard, input seismic sources originating from the 2014 Earthquake Model of the Middle East (EMME14) (Şeşetyan et al., 2018) over Makran territory are employed to recalculate hazard model as mentioned above, on a spatially-variable grid of 2700 stations. Then, the effect of results in seismic hazard of the Makran region is investigated using the OpenQuake (OQ) engine, the open-source software for seismic hazard and risk assessment promoted by the Global Earthquake Model (GEM) initiative (Pagani et al., 2014).

The method has been tested for peak ground acceleration (PGA) and spectral response accelerations (SA) of 0.2 and 1.0 sec. Figure 1 displays the RP of the amounts of the PGAs having 1% PoE of collpaspe LS in 50 years throughout the Makran coastline and sought eastern of Iran. This RP levels can be comparable with (Şeşetyan et al., 2018) as well as values suggested by the Iranian seismic code (Standard No. 2800). The map shown in Figure 1, demonstrated that the spatial distribution of hazard intensity is crucially different, with respect to the hazard maps from previous studies. The RT-based seismic hazard maps of PGA, SA (0.2 sec) and SA (1.0 sec), across the region will be presented as well. The results show that the risk-targeted GMs tends to change compared to uniform hazards. The conservatism related with the current seismic design standards often leads to unrealistically high costs of construction or retrofitting practices in the Makran region. Concerning this issue, the study especially demonstrates the potential of using risk-targeting ground motions in future applications (work is in progress).

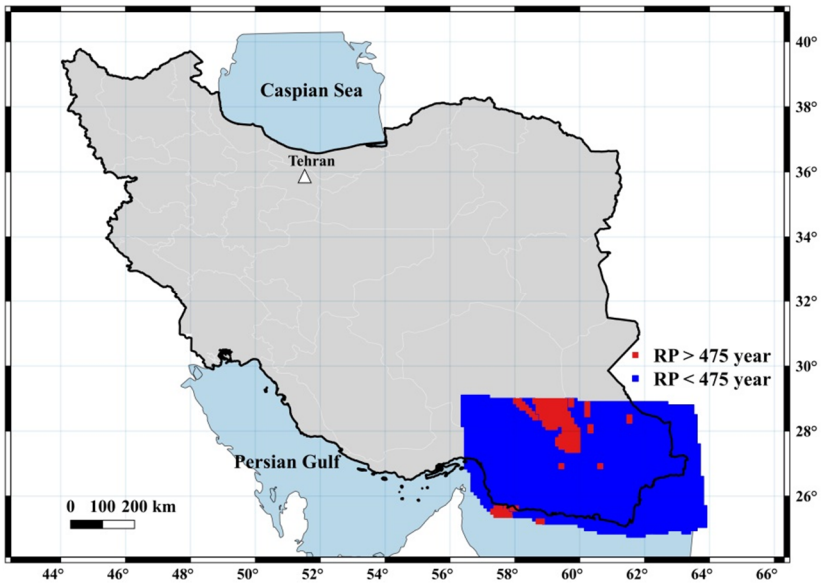

Figure 1. Preliminary results for return period of the PGA having 1 % probability of exceedance of collapse limit-state at individual sites of the Makran region.

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